semi-axis major of the primary orbit is 22·74 astronomical units, while that of the secondary orbit is 1·5 astronomical units, and the combined mass is 1·6 times that of the sun. The whole system of 70 Ophiuchi is thus contained in a space less than that occupied by the solar system; the orbit of the bright companion being intermediate in size between those of Uranus and Neptune, while the action of the dark satellite causes it to describe a secondary orbit corresponding in size with that of Mars (*Astronomical Journal*, No. 363).

Minor Planet Photography.—The great value of the photographic method of recording the positions of known minor planets, and in searching for new ones, is admirably illustrated by the results obtained by M. Charlois (*Bulletin Astronomique*, January). Between November 18, 1894, and August 29, 1895, forty-one plates were exposed by him at the Nice Observatory on suitable parts of the sky, and only nine of these failed to show traces of the objects sought. In the remaining photographs forty-four known planets and eleven new ones were recognised. Four of the new ones were of the 11th magnitude, three of the 12th, one of the 13th, and three of the 14th, while eleven of the old planets were of 10th magnitude or brighter. The newly-discovered planets are thus among the smallest of this class of bodies. Up to the end of last year the patience of M. Charlois had been rewarded by the discovery of eighty-three minor planets, or a little more than one-fifth of the total number at present known.

Theory of Comets' Tails.—It has long been imagined that the phenomena of comets' tails are in some way due to a solar electrical repulsion, and additional light is thrown on the subject by recent physical researches. Several investigators have shown that when ultra-violet light falls on an uncharged body the surface disintegrates, the particles which fly off being charged negatively, while the body itself becomes positively charged. Applying this to the case of a comet, Prof. Fessenden suggests that negatively charged particles are emitted from that side of a comet which is turned towards the sun, while the nucleus has a positive charge (*Astrophysical Journal*, vol. iii. No. 1). According to J. J. Thomson's experiments, the fact that the C line of hydrogen is brighter than the F line indicates that the sun's chromosphere is negatively electrified, and hence the disintegrated particles of the comet will be subjected to four forces; namely, the force due to gravitation, a second force to the repulsion of the negative charge on the sun, a third due to the attraction of the positively charged nucleus, and a fourth due to the repulsion of all the other similarly electrified particles. The shape of the tail is the resultant effect of these four forces. The observed effects do not demand an improbably great solar potential, the value calculated being 15,000 volts. Accepting the theory, the contraction of the head, the partition of comets, multiple tails, and other appearances seem to find a reasonable explanation. The increasing positive charge of the nucleus as the sun is approached will result in an increased solar electrical attraction, and the effect will be the same as that which would be produced by a resisting medium; that is, the period will be shortened, as in the case of Encke's comet.

The fact that the most frequently observed spectrum of a comet's tail is like that of a candle flame, indicates, according to J. J. Thomson's experiments, that the particles of carbon are negatively electrified, and this is quoted in favour of the theory. It may be pointed out, however, that there is no such direct evidence to show that the nucleus is positively charged, as required by the theory.

The Rotation Period of Venus.—A valuable contribution to the study of the rotation period of Venus has been made by Prof. Tacchini (*Atti Reale Acad. Lincei*, vol. v. p. 3). Observations made at the Collegio Romano during last summer, tended in favour of Schiaparelli's view that the rotation period of the planet is 224·7 days, that is, equal to the sidereal revolution. He now announces that continued observations, made under the best atmospheric conditions towards the end of 1895, have led to the same conclusion. The observations terminated on December 19, and on some occasions they extended over very considerable intervals on the same mornings. On November 28, for example, work was commenced at 5.45 and continued until 11 o'clock, and during this time the same features were constantly observed on the illuminated part of the planet. A nebulous arc on the dark part of the planet, near the southern cusp, observed in September last, was not seen in the recent observations.

THE INTERNATIONAL GEODETIC CONGRESS AT BERLIN.

Last month, in the new Reichstag palace, in Berlin, the official international Congress of Geodesy met together. The members represented seventeen States of Europe, Asia, and America.

At this conference the delegates of France were: MM. H. Faye, Vice-President of the Bureau des Longitudes; Tisserand, Director of the Paris Observatory; Bouquet de la Grye, the retired Engineering Hydrographer in charge of the Marine; Bassot, Superintendent of the Geodetic Section of the Geographical Service of the Army; and Ch. Lallemand, Director of the General Levelling of France.

The Congress was welcomed, in the name of the Prussian Government by Dr. Bosse, Minister of Public Instruction. After recalling the fact that the International Geodetic Association was founded by the Prussian General Baeyer, Dr. Bosse briefly sketched the history of progress made in the different sections of geodesy during the last ten years, under the happy influence of the Association.

In reply to the Minister, M. Faye, President of the Association, very appropriately remarked that although Germany has done much for geodesy in the last fifty years, still France has the honour of having, during the last century, set the example.

Following this Prof. Foerster, Director of the Berlin Observatory (President of the Congress), described the recent discovery of the variation of latitude.

M. Fergola (Director of the Naples Observatory) has proposed since 1883 that observations should be organised in a permanent manner in observatories equally distributed round the earth, and situated at more or less the same latitude, in order to observe the small possible movements of the terrestrial axes. The first signs of these movements, noticed by M. Küstner at the Berlin Observatory, were reported to the Conference held at Salzburg in 1888 by the International Geodetic Association. The Association took up the question, and instituted two years afterwards an astronomical station of observations at Honolulu (Sandwich Isles), to control the results made in Europe. The success of this undertaking has now led the permanent commission of the Association to propose the realisation of M. Fergola's plan. This realisation will be greatly facilitated by the recent construction of a special photographic telescope, of which the first results were very interesting.

We will confine ourselves to naming some of the principal scientific communications made to the Congress. M. de Kalmar (Austrian delegate, and reporter on accurate levelling) announced the fact that, in the last three years, the total length of these levellings in Europe has increased from 20,000 kilometres, and exceeds to-day 120,000 kilometres. Colonel Bassot reported that three geodetic bases have just been measured in Roumania with the instruments of the Geographical Service, and with the help of French officers. Another base must be measured next in Turkey under the same conditions. M. Bouquet de la Grye announced that the Bureau des Longitudes have just undertaken, with the help of the officers of the French Marine, the execution of a new magnetic map of the world. M. Lallemand reported, amongst the principal networks of accurate levellings of Europe, the existence of systematic errors—the cause as yet unknown—the probable value of which, although much greater than those of accidental errors, only considered up till now, is calculated to be between 0·1 mm. and 0·2 mm. per kilometre for the French, Spanish and Prussian networks. This being so, the researches and efforts of those in charge of great levelling undertakings should certainly aim at reducing the systematic errors.

According to verifications made in Austria by Colonel Sterneck, and confirmed by other observers, the intensity of gravity has a slight diurnal oscillation. The communication of the captain of the ship *Von Kalmar* states that the officers of the Austrian Marine have determined the intensity of gravity in thirty-nine stations, situated in different seas of the world. Prof. Vogler, of Berlin, exhibited an accurate levelling instrument (*niveau de précision*) constructed on the principle of the cathetometer, and metallic levelling rods, formed of two rods of steel coupled with a rod of zinc, and covered with a layer of aluminium. These new arrangements would permit the inventor to reduce the accidental errors of the levelling; but it is doubtful if it would be the same for systematic errors.

The principal and most laborious task of the Congress consisted in drawing up a new diplomatic convention, in place of that which, since 1886, has governed the existence of the Association, and expires next year. For this reason, important modifications have been introduced into the future functions of the Association.

In view of the construction and maintenance of international stations for geodetic or astronomical observations, its budget will be increased from 20,000 to 75,000 francs.

Under the new organisation, the various German States have been fused into the German Empire with one vote. The old permanent commission, which used to meet once a year, now disappears. Only the general conferences will be continued, and they will take place every three years, as formerly. In these assemblies special commissions will be formed for each branch of study of the Association.

M. Faye has been unanimously re-elected as President of the new Association, with General Ferrero, Italian Ambassador in London, as Vice-President, and Dr. Hirsch, Director of the Observatory in Neuchâtel (Switzerland), as Secretary.

MEETINGS OF AFFILIATED SCIENTIFIC SOCIETIES IN AMERICA.

AN important series of scientific meetings was held at Philadelphia, December 26-28, under the leadership of the American Society of Naturalists, and including six other Societies. The opening address of President Edward D. Cope to the Naturalists' Society was on the formulation of the natural sciences. A discussion on the flora and fauna of the Antarctic and adjacent regions occupied most of the time of this society. Angelo Heilprin opened the discussion. He said that very little was known about the Antarctic region. It appeared to him that the coast-line of this region did not outline a continent, but only a group of islands. The supposed continent had been regarded as destitute of vegetable life till lichens were discovered there last year. It is thought from geological formations that the continent was once connected with Australia, South America, and perhaps Africa. W. B. Scott said that a study of fossils of animals shows that Australian forms are found in South America, but no South American forms in Australia; thus indicating that there was first a connection between Australia and the southern continent, and later between South America and the southern continent.

N. L. Britton gave a list of plants, and Theodore Gill of fresh-water fishes, to show the connection between the southern continent and Australia and South America.

The officers elected for the Naturalists' Society are: President, W. B. Scott; Vice-Presidents, W. G. Foster, C. O. Whitman, and Theodore Gill; Secretary, H. C. Bumpus; Treasurer, J. B. Smith.

There was a large attendance at the meeting of the Geological Society of America. President N. S. Shaler (in the chair) read a paper on the relations of geologic science to education. Among other papers read were one by C. R. Van Hise, on the movements of rocks under deformation, and a description, by Sir Robert Bell, of the land about Hudson Bay.

Officers elected were: President, Joseph Le Conte; Vice-Presidents, Charles H. Hitchcock and Edward Orton; Secretary, H. L. Fairchild; Treasurer, J. C. White; Editor, J. S. Brown.

The American Psychological Society listened to the annual address of the President, J. M. Cattell, and to a large number of papers by members. An interesting discussion on "Consciousness and Evolution," was opened by William James, and participated in by E. D. Cope, J. M. Baldwin, C. Sedgwick, G. T. Ladd, G. S. Fullerton, J. H. Hyslop, D. S. Miller, and Wesley Mills.

The Anatomical Society of America was briefly addressed by the President, Thomas Dwight. An interesting paper was read by Burt G. Wilder, on "The Cerebral Fissures of Two Philosophers." The brains referred to were those of Chauncey Wright, of Cambridge, and James Edward Oliver, of Cornell, both of which the lecturer exhibited.

Officers elected were: President, Frank Baker; Vice-Presidents, B. G. Wilder and F. J. Shepherd; Secretary and Treasurer, D. S. Lamb.

The American Morphological Society had papers by C. S. Minot, Bashford Dean, and others, and elected the following officers: President, E. L. Mack; Vice-President, H. F. Osborne; Executive Committee, E. G. Conklin and W. Patten.

A meeting of the American Physiological Society was held, at which several papers were read.

The meeting of the American Folk-lore Society was, of course, the most popular. Washington Matthews presided, and read a paper on the poetry and music of the Navajoes. He finds that the tribe has many legends, songs, and formulated prayers. They have an elaborate religion, with symbolism and allegory that might vie with the Greeks. Daniel G. Brinton read a paper on "American Cuss Words," and J. H. McCormick on "Folklore of the Southern Negroes." Captain John G. Bourke read "Notes on some Arabic Survivals in the Language and Folklore of the Rio Grande Valley," in which he traced the similarity of names which the Mexican uses for his common articles of food with those used by the Moslem; and also showed similarity of customs of the two nations.

Officers elected were: President, John G. Bourke; Vice-Presidents, Stewart Culin, Franz Boaz; Councillors, J. W. Ellsworth; Hall Chatelain, J. H. McCormick.

A general lecture was given on Thursday evening by Prof. Wm. B. Scott, on the "Lacustrine Formations of North America and their Mammalian Fossils." The vast plains east of the Rocky Mountains were, in the Pliocene age, fresh-water lakes. Large numbers of fossils, particularly mammals, have been taken from them. Prof. Scott argued the identity of the American fauna of that age with that of France and the valley of Lausanne in Switzerland at the same period.

The affiliated societies were entertained during the days of session by the University of Pennsylvania, and a banquet was given on Friday evening at the Hotel Lafayette. Prof. Cope presided, and the address of welcome was made by Dean Fullerton, of the University.

GEOLOGY IN GLASGOW UNIVERSITY.[1]

YOU are doubtless aware that last year I entertained and expressed the rash expectation that I should not again meet a class as lecturer on geology. "I thought to pass away before, and yet I still am here." An explanation is therefore necessary; I must, in fact, detail the history of the subject in this University, so as to purge myself of censure in respect that the University is, in this particular, behind the time, and far behind what Glasgow, above all, has a right to expect that its University should be.

When I came to Glasgow the old custom prevailed of interlarding the lectures on zoology with those on geology. In my time in Edinburgh, Edward Forbes gave four lectures on zoology, setting aside Friday for geology. In 1867 I separated the two subjects, lecturing twice daily during that summer, and raising a brief revolt among the medical students, who thought themselves defrauded of their rights. Brief, for the clamour died quickly when they found themselves at liberty to attend the second lecture without paying a fee; their abnormal thirst for knowledge at once contented itself with what was required for the professional examinations. This was the first complete course given in Scotland, and anticipated by four years the foundation of the Murchison chair in Edinburgh. In 1872, on the establishment of a degree in science, geology was made compulsory for that, as it had previously been for the certificate of proficiency in engineering science. Thereon I began to urge the claims of a subject which had been thus quietly introduced to a prominence not previously granted to it in this city. The Mining School started in Anderson's College some years before had collapsed, those who owed wealth to their mineral property taking no interest in the effort which not even the excellence of Mr. Prior as a teacher could sustain. The hearty support given me in my crusade by Dr. (now Sir Charles) Cameron deserves to be recorded, for he was the only one who appreciated the importance of the movement, the only one who stirred a finger to help me. Wealthy coal- and iron-masters saved their money, some by the Mrs. McLarty plea that they did well enough without trained men, others by modestly saying that they could not properly intrude where their wealthier neighbours saw no need for action. I need not comment on the want of public spirit, of patriotism displayed, which astonished me more perhaps than it would now; but it seemed, and seems strange that a country which boasted Hutton, Playfair, Hall, Macculloch C. Maclaren, Hugh Miller, Lyell, Murchison, A. C. Ramsa

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[1] From Introductory Lecture to Course of Geology in Glasgow University by Prof. John Young.